

A Century of Physiological Change: Trends, Explanations, and Implications

Dora L. Costa
MIT and NBER

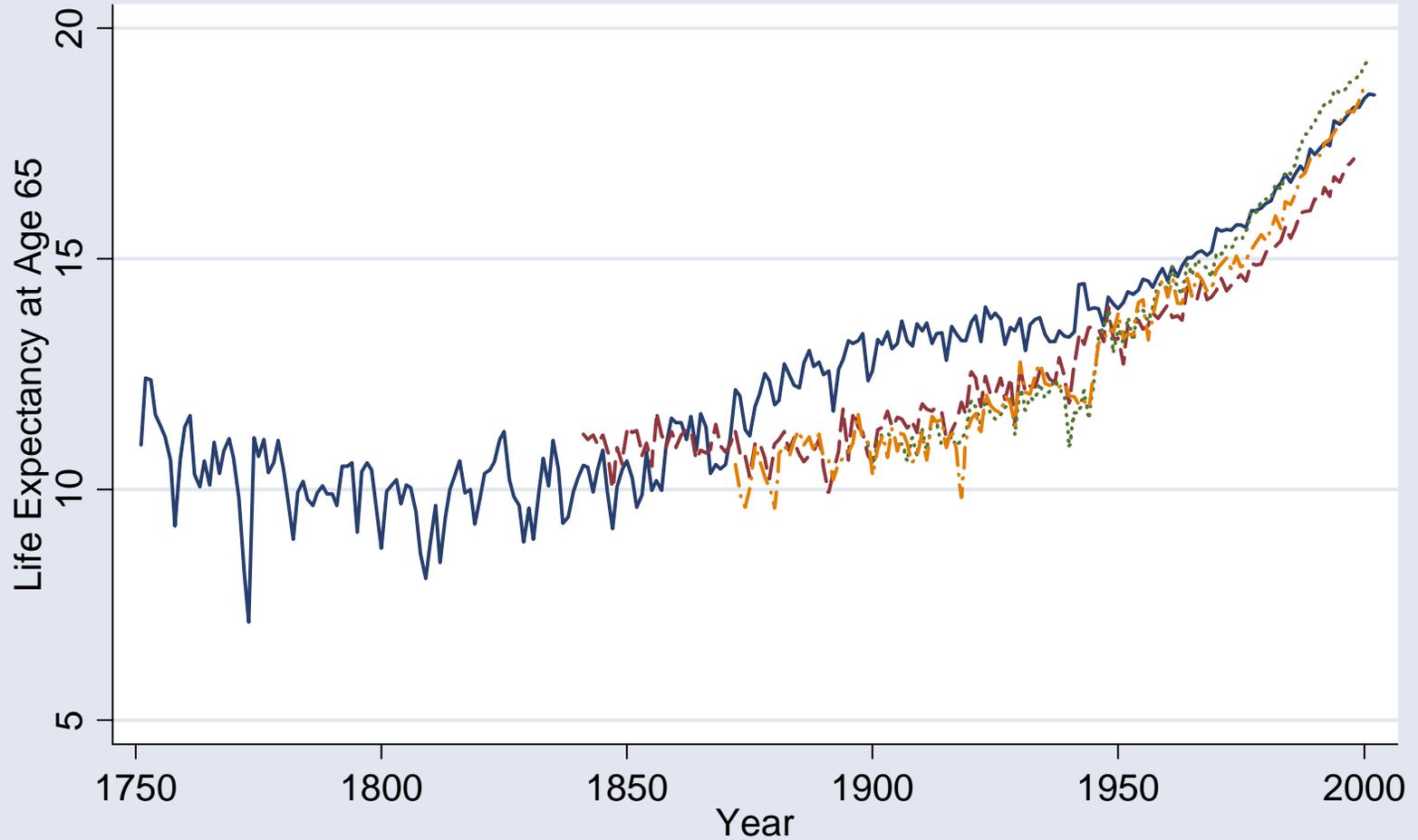
Main Findings Union Army Project

- Trends
 - Very high prevalence rates chronic conditions and functional limitations circa 1900
- Explanations
 - Infectious disease
 - Occupational stress
 - Early life environmental factors
- Implications
 - Using information on early life environmental factors to predict future trends

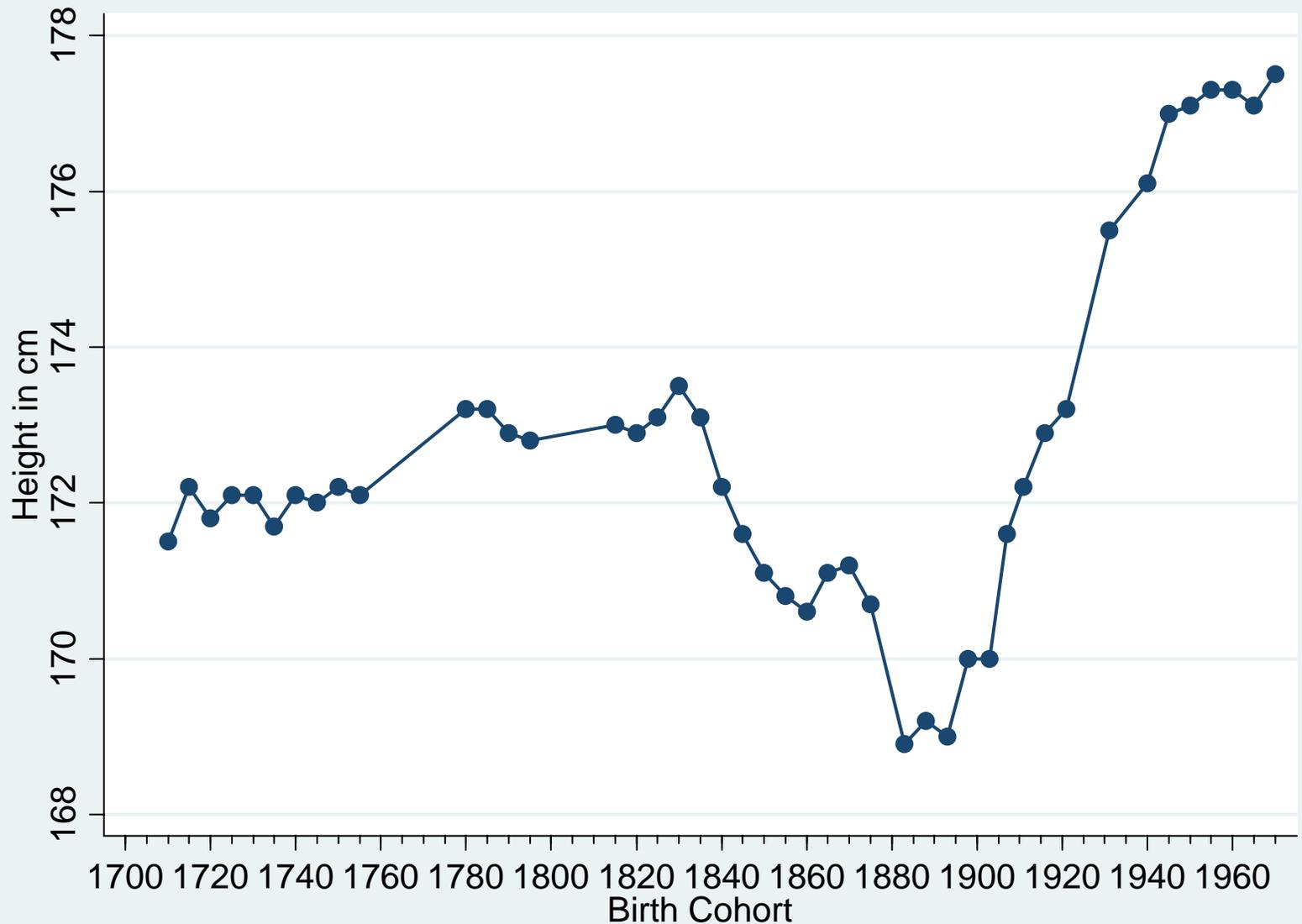
Trends

- Life expectancy
 - Rising at increasing rate
- Height
 - In US cycles but sharp increase heights of cohorts born 1900-1970, leveling since 1970
- BMI
 - Becoming heavier
- Chronic Conditions and Functional Limitations
 - Recent acceleration in improvement

Life Expectancy at Age 65, Selected Countries



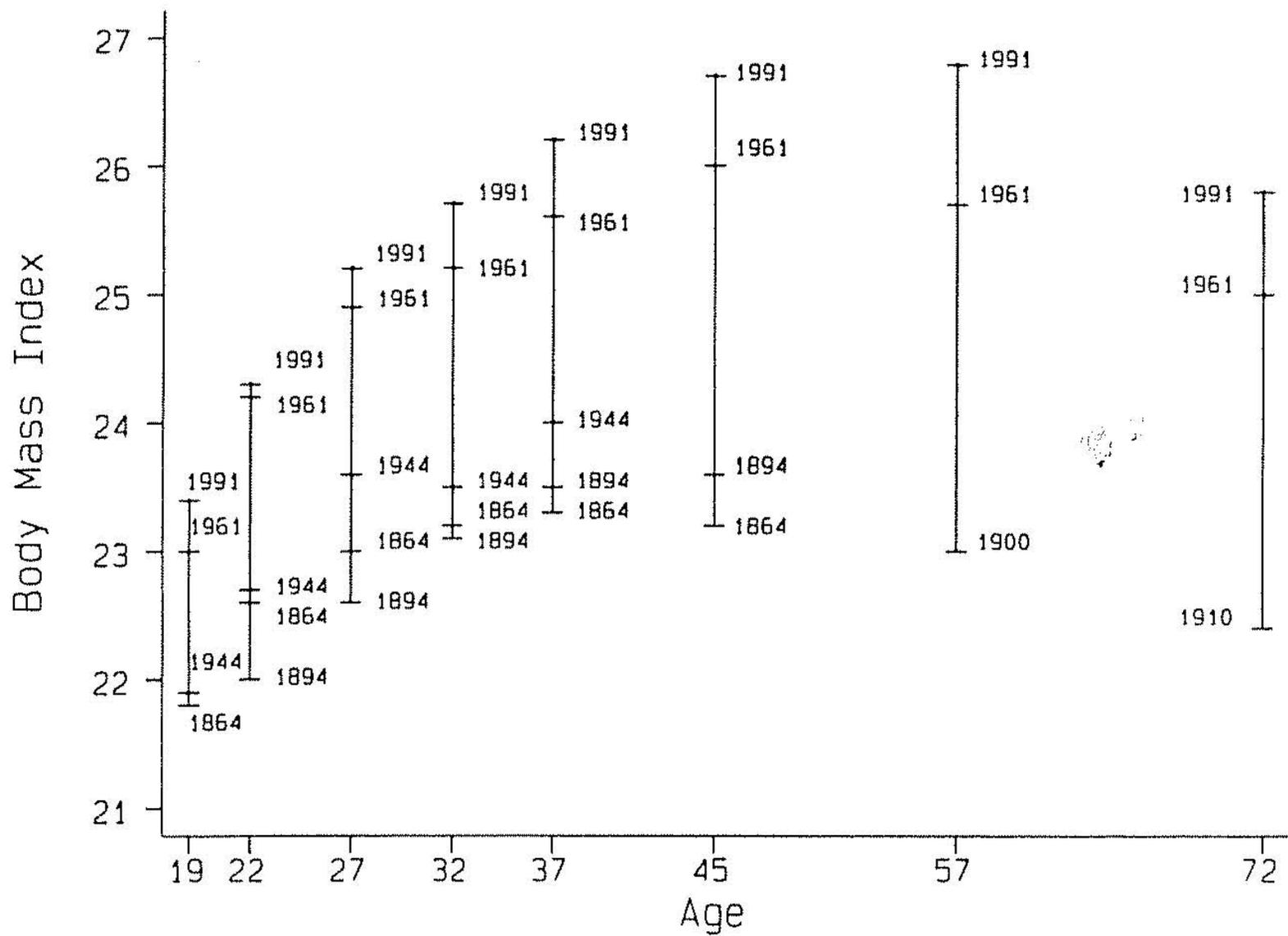
Heights by Birth Cohort, Native-Born (Costa and Steckel 1997)



Boys Picking Over Garbage, Boston, 1909



Mean BMI by Age Group (Costa and Steckel 1997)



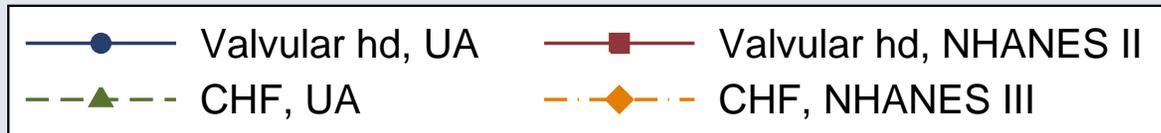
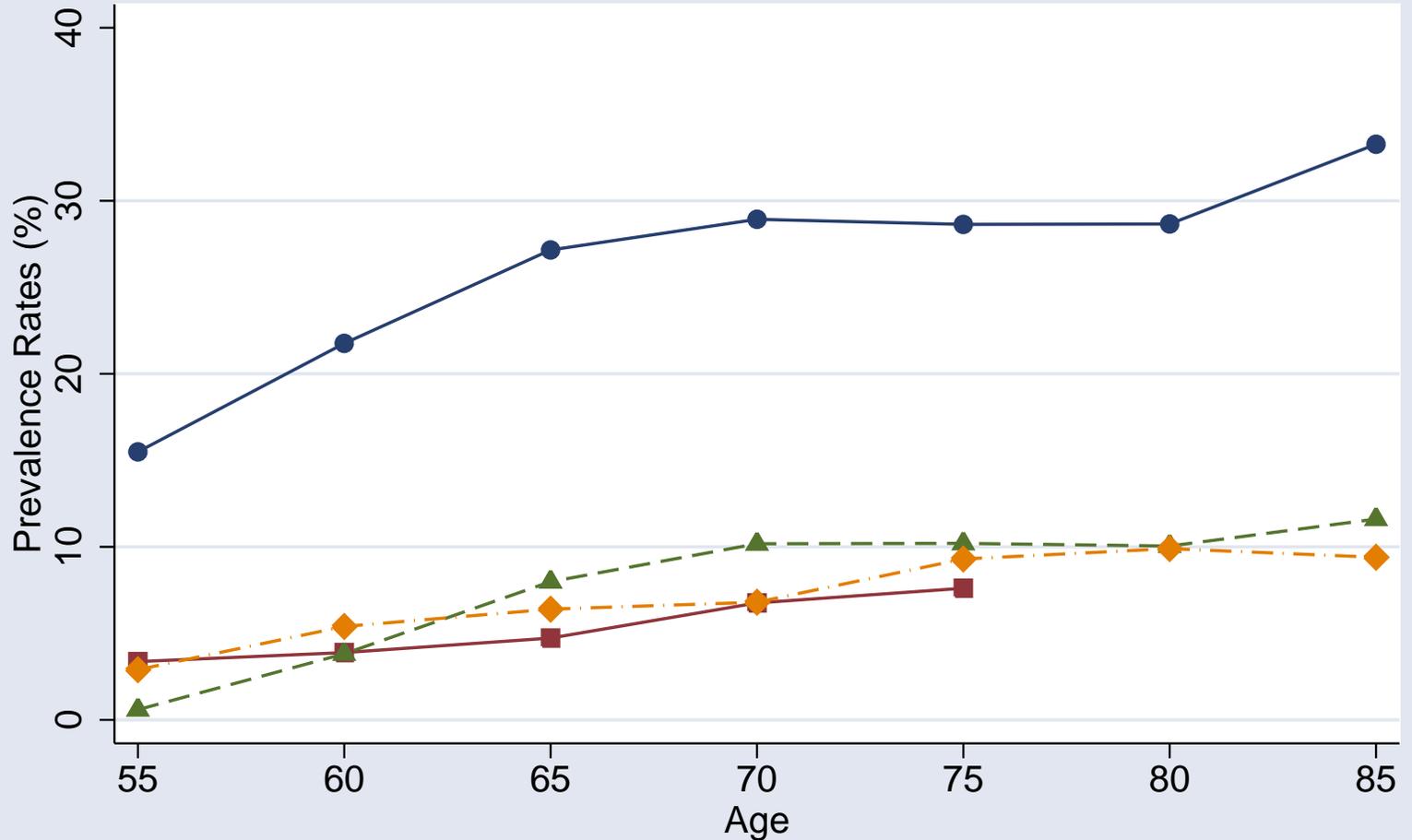
Prevalence Rates, Age 60-74 (Costa 2000, 2002)

| | UA | NHANES I & II | NHANES III |
|---------------------|------|------------------|---------------|
| Decreased Breath | 15.4 | | 8.3 |
| Adventitious Sounds | 29.1 | | 4.0 |
| Valvular HD | 26.9 | 3.6 | |
| CHF | 10.0 | | 7.0 |
| Joint problems | 55.0 | | 35.2 |
| Back problems | 49.5 | | 30.2 |

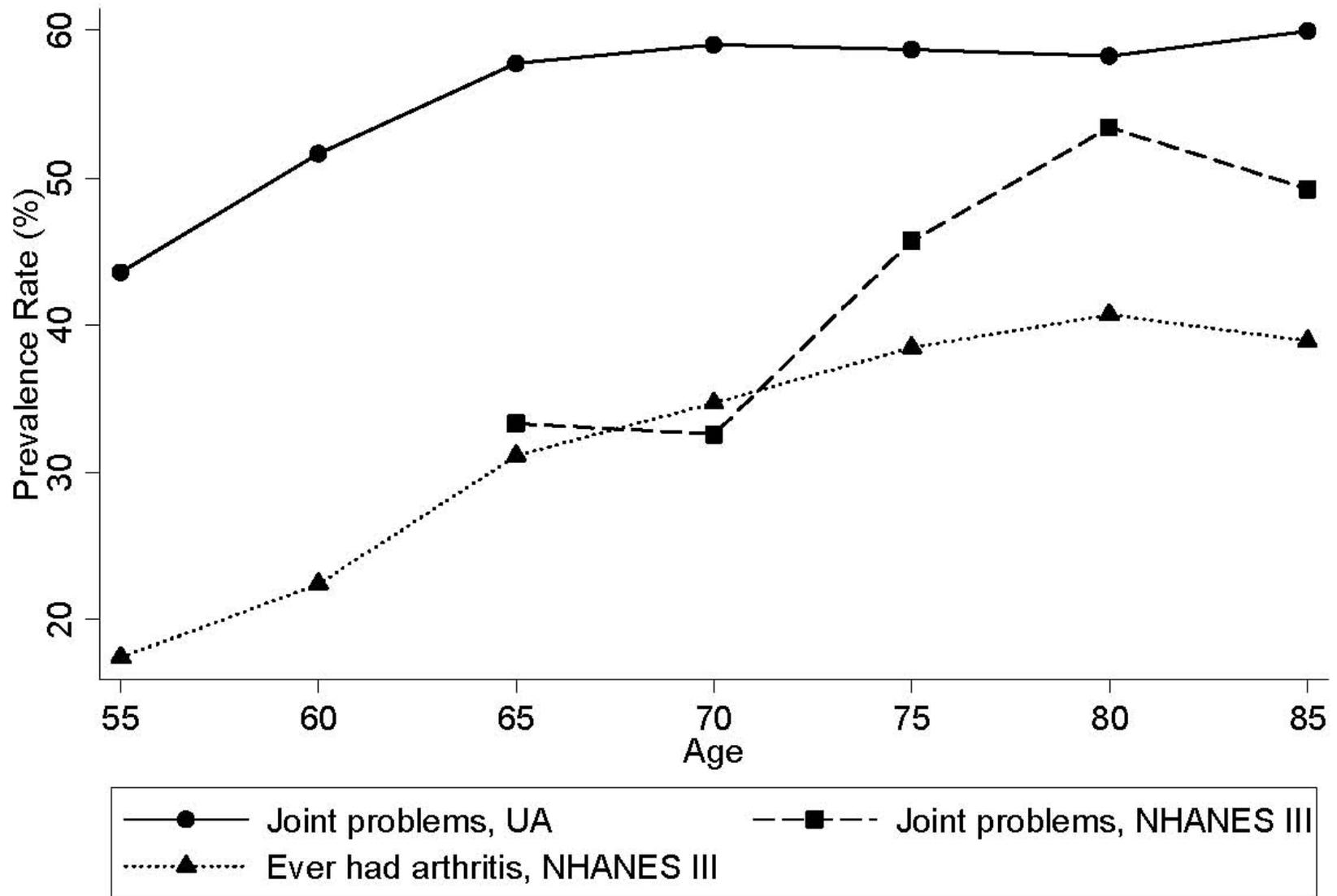
Functional Limitation Rates (%), Costa (2002)

| | Age 50-64 | | Age 60-74 | |
|----------------------|------------|------------|------------|------------|
| | Union Army | NHANES III | Union Army | NHANES III |
| Difficulty bending | 44.4 | 7.5 | 53.8 | 16.1 |
| Difficulty Walking | 28.5 | 10.4 | 36.6 | 13.8 |
| Paralysis | 4.8 | 0.9 | 6.1 | 2.7 |
| Blind in >= 1 eye | 3.4 | 1.5 | 4.5 | 3.1 |
| Deaf in >=1 ear | 3.2 | 1.4 | 4.1 | 2.7 |

Heart Disease Rates by Age, UA and NHANES (Costa 2006)



Musculoskeletal Prevalence Rates and Age, UA and NHANES (Costa 2006)



Functional Limitations and Chronic Conditions: Trends

- Costa (2002): declines in functional limitation of 0.6% per year between 1910 and 1990s
- Costa (2000): average decline in chronic respiratory problems, valvular heart disease, arteriosclerosis, and joint and back problems 0.7% per year, 1900s-1970s/1980s

Are Chronic Conditions Less Debilitating?

- Costa (2002): 24% of decline in functional limitations due to decreases in debilitating effects of chronic disease, 37 % due to reduced chronic disease, and remainder unknown

Recent Acceleration Disability Decline, Functional Limitation Improvement, and Decline Chronic Conditions

- Disability decline accelerating among 65+ (Manton, Corder, and Stallard 1997; Manton and Gu 2001):
 - 1982-89: 1.1% per year disability decline
 - 1989-94: 1.5%
 - 1994-99: 2.1%
- Functional limitation trends similar
- Clinician reports of chronic conditions show continuous improvements since 1970s (Waidmann, Bound, and Schoebaum 1995)

How do we know about health in the past?

- Robert Fogel's Union Army data
- ~39,000 white soldiers
 - Military records, pension records (including detailed medical records) linked to 1850, 1860, 1880, 1900, and 1910 censuses
- ~6,000 black soldiers
 - Same records but not earlier censuses

A. Declaration for Original Invalid Pension.

Under Act of July 14, 1862.

State of Tennessee,
County of Montgomery ss.

On the date hereinafter mentioned, personally appeared before me, a Clerk of the County Court, within and for the County and State aforesaid Lucien Barker resident of the city of Clarksville, County of Montgomery State of Tennessee who being duly sworn according to law, declares that he is the identical Lucien Barker who was enrolled on the 7th day of November 1864, and served in Company K of the 1st Regiment of U. S. Cold Troops and was discharged at Nashville, Tennessee, on the 21st day of January 1866; that his personal description is as follows: Age 35 years; height, 5 feet 7 inches; complexion, black; hair, black; eyes, black. That while a member of the organization aforesaid, in the service and in the line of his duty, at Nashville, in the State of Tennessee, on or about the day of 1864-5, he contracted rheumatism, disease of head, impaired eyesight and tumor on right shoulder, from exposure.

That he was treated in hospitals as follows: [Here state the name or number, and the location of all hospitals in which treated and the dates of treatment.] Was not treated in hospital.

That he has not been employed in the military or naval service otherwise than as stated above Has not been in military or naval service of U. S. since Jan. 21st, 1866.

That since leaving the service this applicant has resided in the County of Montgomery, Tenn ever since being discharged from services on Jan. 21-1866

That prior to his entry into the service above named he was a man of good, sound physical health, being, when enrolled, a farmer That he is now materially disabled from obtaining his subsistence by manual labor by reason of the injury or disability, above described, received in the service of the United States; and he therefore makes this declaration for the purpose of being placed on the invalid pension roll of the United States.

He hereby appoints, with full power of substitution, MILO B. STEVENS & CO., of Washington Dc, their successors or legal representatives, his true and lawful Attorneys to prosecute his claim. That he has received applied for pension under Act of June 27/90 @ \$12. That his Post-office address is Clarksville, County of Montgomery, State of Tennessee. his mark

Attest: A. J. Davidson Claimant's Signature, Lucien Barker

DECLARATION FOR INVALID PENSION.

ACT OF JUNE, 27, 1890.

To be executed before a Court of Record or some Officer thereof having custody of its Seal, or a Notary Public, or a Justice of the Peace, whose Official Signature shall be verified by his own Official Seal, if he has one, or by the proper Clerk, under Seal.

State of Tennessee, County of County, ss:

On this 15th day of July, A. D. one thousand eight hundred and ninety

personally appeared before me, a justice of the Peace.

within and for the county and State aforesaid Lucien Barker

aged 61 years, a resident of the City of Clarksville, county of

Montgomery, State of Tennessee, who, being duly sworn according to law,

declares that he is the identical Lucien Barker who was enrolled on the

day of 1864 in Company N. Here state rank, company, and regiment in military service, or

Regiment - U. S. C. T.

in the service of the United States in the War of the Rebellion, and served at least ninety days, and was

honorably discharged at Nashville, Tenn, on the 21

day of Jan., 1866. That he is now partially unable to earn a support

by manual labor by reason of Enlargement on right shoulder

Blind in the right eye; The right arm is nearly useless.

That said disabilities are not due to his vicious habits, and are to the best of his knowledge and belief per-

manent; that he has not applied for pension under application No. ; that he is a

pensioner under Certificate No. If a pensioner, the certificate number only need be given; if not, give the number of the former application, if one was made.

That he makes this declaration for the purpose of being placed on the pension-roll of the United States under

the provisions of the Act of June 27, 1890.

He hereby appoints, with full power of substitution and revocation, R. D. Newton,

Clarksville, of Montgomery Co

State of Tennessee, his true and lawful attorney to prosecute his claim, and to receive

therefor a fee of ten dollars; that his post-office address is Clarksville

county of Montgomery, State of Tennessee.

Lucien Barker

Attest: 1 A. W. Saunders

2 John Bell

Two witnesses who can write sign here.

INVALID PENSION.

629639
Knox

Claimant, Lucien Barker
 P. O., Clarksville Rank, Private
 County, Montgomery Company, 1st
 State, Tenn Regiment, 101 USC Vol Regt
 Rate, \$ 2.00, per month, commencing July 1 1890

Disabled by Loss of sight of right eye & tumor on right shoulder

RECOGNIZED ATTORNEY.

Name, R. D. Newton Fee, \$ 10 Agent to pay.
 P. O., Clarksville Tenn Articles filed, 1890

APPROVALS.

Submitted for Admission May 6, 1891, John Howell, Examiner.
 Approved for Admission June 18 " " Approved for Loss of sight of right eye and tumor on right shoulder
Ch 12

Que 22, 1891 B. B. Baring Legal Referee. Permit July 7, 1891. Houston W. D. Ingram Medical Referee.

now pensioned under other laws. Last paid to _____, 1891, at \$ _____
 Pensioned from _____, 18____, at \$ _____, for _____

SERVICE SHOWN BY RECORD.

Enlisted Nov 7, 1864, honorably discharged Jan 21, 1866
 Re-enlisted not, 18____, honorably discharged _____, 18____
 Declaration filed 18 July, 1890, alleges permanent disability, not due to vicious habits,
 from enlargement on right shoulder & tumor on right eye (Informal)
Discharge of Dec 15 1890 alleges enlargement of right eye & tumor on right shoulder

Attention is invited to the outlines of the human skeleton and figure upon the back of this certificate, and they should be used whenever it is possible to indicate precisely the location of a disease or injury, the entrance and exit of a missile, an amputation, &c.
 The absence of a member from a session of a board and the reason therefor, if known, and the name of the absentee, must be indorsed upon each certificate.

Inset character and number of claim: Add Pension Claim No. 629 639
(State above whether original, increase, or restoration.)
 Name and rank of claimant: Lucian Barker, Rank, Priv
 Company K, 101. Reg't U.S.C.T. Hopkinsville Ky State,
(Post-office address of the Board.)
 Claimant's post-office address: Clarksville Tenn June 20th, 1894
(Date of examination.)

We hereby certify that in compliance with the requirements of the law we have carefully examined this applicant, who states that he is suffering from the following disability, incurred in the service, viz: Disease of head, eyes, tumor on right side & Rheumatism
 and that he receives a pension of Twelve (12) dollars per month.

He makes the following statement upon which he bases his claim for Add (Original, increase, restoration, Ac.)
 Had Rheumatism first while in service
 It troubles me mostly in my legs.
 Am troubled with neuralgia in my teeth & face
 Am unable to see abt out of my right eye
 Began losing sight during service also
 The tumor on my shoulder began to grow
 while I was in service Am 3/4 disabled

Upon examination we find the following objective conditions: Pulse rate, 66; respiration, 20; temperature, 98.5; height, 5 feet 6 1/2 inches; weight, 160 pounds; age, 60 years. We find no swelling of joints

but tendons about knees & hips are slightly contracted. Claimant's movements are not as agile & free as in his younger days. We find heart's action markedly irregular & the intermissions occurring every 4 or 5 beats ^{was} are pronounced. The action of the ^{was} trachea is probably the sounds indistinct, on acct of the blended indistinct natural sounds, it is difficult to distinguish the unnatural ones. But the character of the intermissions shows marked valvular deficiency. Claimant has a dry spasmoidic cough due probably to defective circulation. Claimant is fairly well nourished. But muscles are soft & flabby showing his nonactivity and it is probable that any sudden exertion might prove fatal, with the present condition of his heart. On right shoulder, posterior aspect we find a large tumor 5 by 6 inches in diameter. Also above

He is, in our opinion, entitled to a rating for the disability caused by _____ for that caused by _____, and _____ for that caused by _____

J. B. Donnell Pres. J. W. Blakey Sec'y. J. J. Garmon Treas.

Attention is invited to the outlines of the human skeleton and figure upon the back of this certificate, and they should be used whenever it is possible to indicate precisely the location of a disease or injury, the entrance and exit of a missile, an amputation, &c.
 The absence of a member from a session of a board and the reason therefor, if known, and the name of the absentee, must be indorsed upon each certificate.

Inset character and number of claim: Add Pension Claim No. 629 639
(State above whether original, increase, or restoration.)
 Name and rank of claimant: Lucian Barker, Rank, Priv
 Company K, 101. Reg't U.S.C.T. Hopkinsville Ky State,
(Post-office address of the Board.)
 Claimant's post-office address: Clarksville Tenn June 20th, 1894
(Date of examination.)

We hereby certify that in compliance with the requirements of the law we have carefully examined this applicant, who states that he is suffering from the following disability, incurred in the service, viz: Disease of head, eyes, tumor on right side & Rheumatism
 and that he receives a pension of Twelve (12) dollars per month.

He makes the following statement upon which he bases his claim for Add (Original, increase, restoration, Ac.)
 Had Rheumatism first while in service
 It troubles me mostly in my legs.
 Am troubled with neuralgia in my teeth & face
 Am unable to see abt out of my right eye
 Began losing sight during service also
 The tumor on my shoulder began to grow
 while I was in service Am 3/4 disabled

Upon examination we find the following objective conditions: Pulse rate, 66; respiration, 20; temperature, 98.5; height, 5 feet 6 1/2 inches; weight, 160 pounds; age, 60 years. We find no swelling of joints

but tendons about knees & hips are slightly contracted. Claimant's movements are not as agile & free as in his younger days. We find heart's action markedly irregular & the intermissions occurring every 4 or 5 beats ^{was} are pronounced. The action of the ^{was} trachea is probably the sounds indistinct, on acct of the blended indistinct natural sounds, it is difficult to distinguish the unnatural ones. But the character of the intermissions shows marked valvular deficiency. Claimant has a dry spasmoidic cough due probably to defective circulation. Claimant is fairly well nourished. But muscles are soft & flabby showing his nonactivity and it is probable that any sudden exertion might prove fatal, with the present condition of his heart. On right shoulder, posterior aspect we find a large tumor 5 by 6 inches in diameter. Also above

He is, in our opinion, entitled to a rating for the disability caused by _____ for that caused by _____, and _____ for that caused by _____

J. B. Donnell Pres. J. W. Blakey Sec'y. J. J. Garmon Treas.

These rec-
examine
aff.

This one at base of neck a smaller one
exists 2x2 inches, Both are soft &
freely movable & are probably cystic in
character. We find entire absence of
sight in right eye. Pupil is small
contracted & quite cloudy due to dense
cataract. In appearance left eye seems
normal but Snellens types show vision
in left eye to $\frac{20}{40}$. Claimant is disabled
by reason of Rheumatism Heart
disease and loss of sight of right eye
and tumors on shoulder in a degree
equivalent to the loss of a hand or foot.
J. W. Blakely, M.D.



SURGEON'S CERTIFICATE

IN CASE OF

Lillian Porter
Co. H. 1st Regt U.S.C.

Applicant for *Red*

No. *629.639*

DATE OF EXAMINATION:

June 20, 189*4*

J. W. Blakely, Pres.,

J. E. Cannon, Secy.,

J. E. Cannon, Treas.,

BOARD.

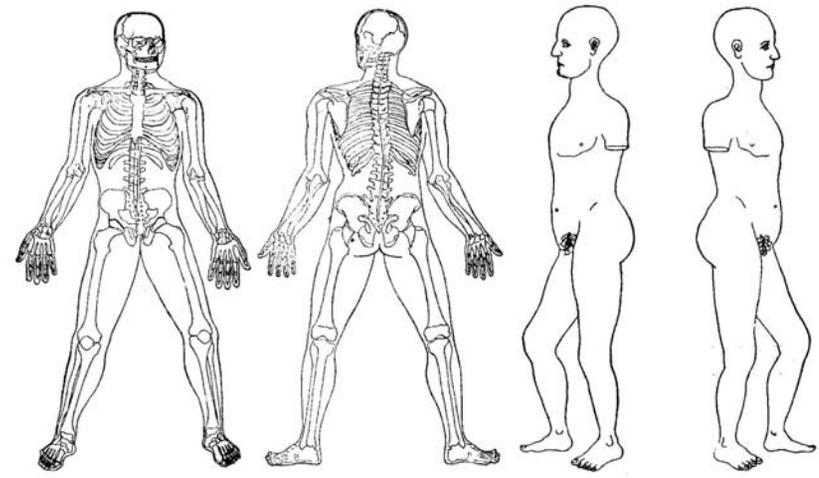
Post office *Hopkinsville*

County, *Christian*

State, *Kentucky*

P. S.—Write your Post-office address plainly and in full.

McAfee



Single surgeons will use this blank, changing "we" to read "I," and "our" to read "my." They will erase the words "Pres.," "Sec'y.," "Treas.," and "Board" where the words appear, and sign at the foot of the certificate, and also on the back of the same.

PROVIDED FURTHER, That all examinations shall be thorough and searching, and the certificate contain a full description of the physical condition of the claimant at the time, which shall include all the physical and rational signs and a statement of all the structural changes. [Ex-tract from Section 4, Act of Congress approved July 25, 1882.]

Act of June 27, 1890

ACCRUED PENSION

Act March 2, 1895

Under Section 4718, R-S.

2-13-
Knot.

Certificate No. 629639 Last Issue July 23, 1891

Name of pensioner, Lucien Barker

Date of death, Dec 6, 1896

Payable to Rebecca Barker (widow)

P. O., Clarksville

Montgomery Co. Tenn.

Accrued Pension Certificate and Order. Pension Certificate and Voucher herewith.

Issued Feb. 28, 1898 Mailed Mar. 3, 1898

Payable to Widow

Relationship to pensioner shown by a verified copy, public records

Prior marriage of both

Shown by testimony showing death of former wife, former husband prior to re-marriage

Fact and date of pensioner's death shown by testimony ²⁻¹⁷⁻⁹⁸ ~~showing~~ 7. & 8. two witnesses.

Submitted for Adm Feb 17, 1898

Approved ^{Feb 19, 1898}

Benjamin
Signs by mark

Sayre F. C., Examiner.

w. B. Bate J. No Pension Certificate or Voucher.
m. e.

REBECCA BARKER,
CLARKSVILLE, TENN.
3-1081
2458824
DEOP REPORT-PENSIONER ACT APRIL

REPR

Cert. No. 459824
Pensioner Rebecca Barker
Soldier _____
Service _____
Class ACT MAY 1, 1920-WIDOW SECTION W

*Mar 13/25
Rem. Wid.*

LAW DIVISION

_____, 192_____
In the above-described case a declaration filed
in this Division indicates that said pensioner died
_____, 19_____

Per _____ Chief, Law Division.

FINANCE DIVISION

30 3/4/25

MAR 12 1925, 192____

The name of the above-described pensioner who
was last paid at the rate of \$ 30 per month
to FEB 4 1925, 19____, has this day
been dropped from the roll because of death
Feb. 15, 1925

J. Randall
Chief, Finance Division.

6-2249

GOVERNMENT PRINTING OFFICE

FEB 25 1925

Why Have Elderly Health and Longevity Increased? Explanations from Union Army Data

- Infectious disease at older ages AND infectious disease in early life led to chronic disease at older ages
- Workers worn out by manual occupations
- Improving prenatal and postnatal conditions (proxied by size of city of early residence, season of birth)

Union Army Morbidity Results (Costa 2000)

- Wartime rheumatic fever increases probability of valvular hd, CHF, joint problems, and back problems at age 60-74
- Wartime malaria increases joint, back, and respiratory problems
- Wartime respiratory infections and tb increase chance of later respiratory problems
- Measles increases probability of valvular heart disease and respiratory problems

Increase in Probability Condition Due to Wartime Disease, UA Men 60-74 (Costa 2000)

| | Valv. HD | CHF | Joint Prob. | Back Prob. | Resp. Prob. |
|----------------|-------------|-----|----------------|---------------|----------------|
| Rheum Fever | .08 | .10 | .20 | .13 | |
| Malaria | | | .15 | .11 | .14 |
| Resp Inf | | | | | .12 |
| TB | | | | | .22 |
| Measles | .11 | | | | .20 |

Explaining Decline Chronic Disease

- 18% of decline in combined category of respiratory problems, valvular heart disease, CHF, arteriosclerosis, and joint and back problems accounted for by reduced infectious disease rates

SES: Occupational Stress

- Manual jobs dominated:
 - In 1900 38% of labor force farm or farm workers and 70% of male, non-farm labor force manual
 - In 1990 3% of labor force farm and 52% of male, non-farm labor force manual
- Manual jobs not mechanized
- Exposure to dust, fumes, and animal and industrial pollutants (both farmers and manual workers)

Plowing, 1868

office in Prince Street, near Broadway—one of the smallest houses in New York, and which looks more like the fire-proof vault of a great bank than the business office of the richest man in America. He is to be seen occasionally at this office, and on his way to and from it walk-

MR. WILLIAM B. ASTOR.—[PHOTOGRAPHED BY GERRY.]

A sketch of a farmer plowing for the first time on a Eastern prairie. The heavy sub-soil plow require three and four yoke of oxen to drag them through the tough, solid soil; and our illustration fully represents the difficulties of prairie plowing.



FLOWING ON THE PRAIRIES BEYOND THE MISSISSIPPI.—[SKETCHED BY THEODORE H. DAVIA.]

224
145

Plowing, 1940



Presented at the National Institutes of Health, September 12, 2006

Increase in Probability Condition Due to Occupation, UA Men 60-74 (Costa 2000)

| | Valv. HD | CHF | Joint Prob. | Back Prob. | Resp. Prob. |
|----------------------------------|-------------|-----|----------------|---------------|----------------|
| Professional or Proprietor, 1900 | | | | | |
| Farmer, 1900 | | | .07 | .10 | |
| Artisan, 1900 | | | | .11 | .09 |
| Laborer, 1900 | | | | | .08 |
| PP, 1860 | | | | | |
| Farmer, 1860 | .08 | | | .13 | .08 |
| Artisan, 1860 | | | | | |
| Laborer, 1860 | .11 | | | .14 | .12 |

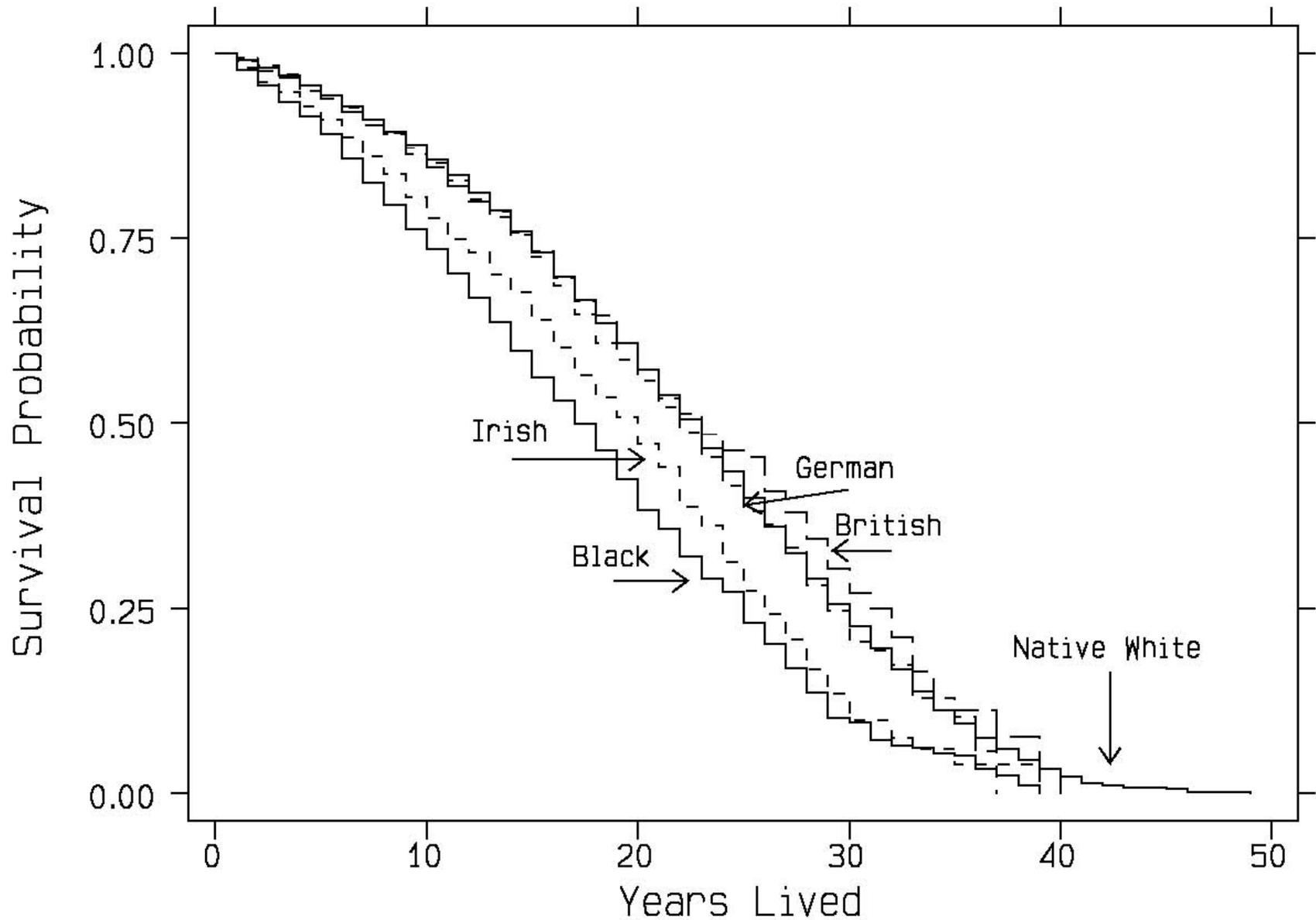
Explaining Chronic Disease Decline

- 29% of decline in combined category of respiratory problems, valvular heart disease, CHF, arteriosclerosis, and joint and back problems, 1910-1970s/80s, accounted for by shift from manual to non-manual occupations

Race, Ethnicity, and Mortality

- SES proxy
- What does SES buy?
 - Better (and more) food and water
 - Less crowded, cleaner housing
 - No work away from home for mother
 - No work for children

Race, Ethnicity, and Survivorship, UA (Costa 2004)



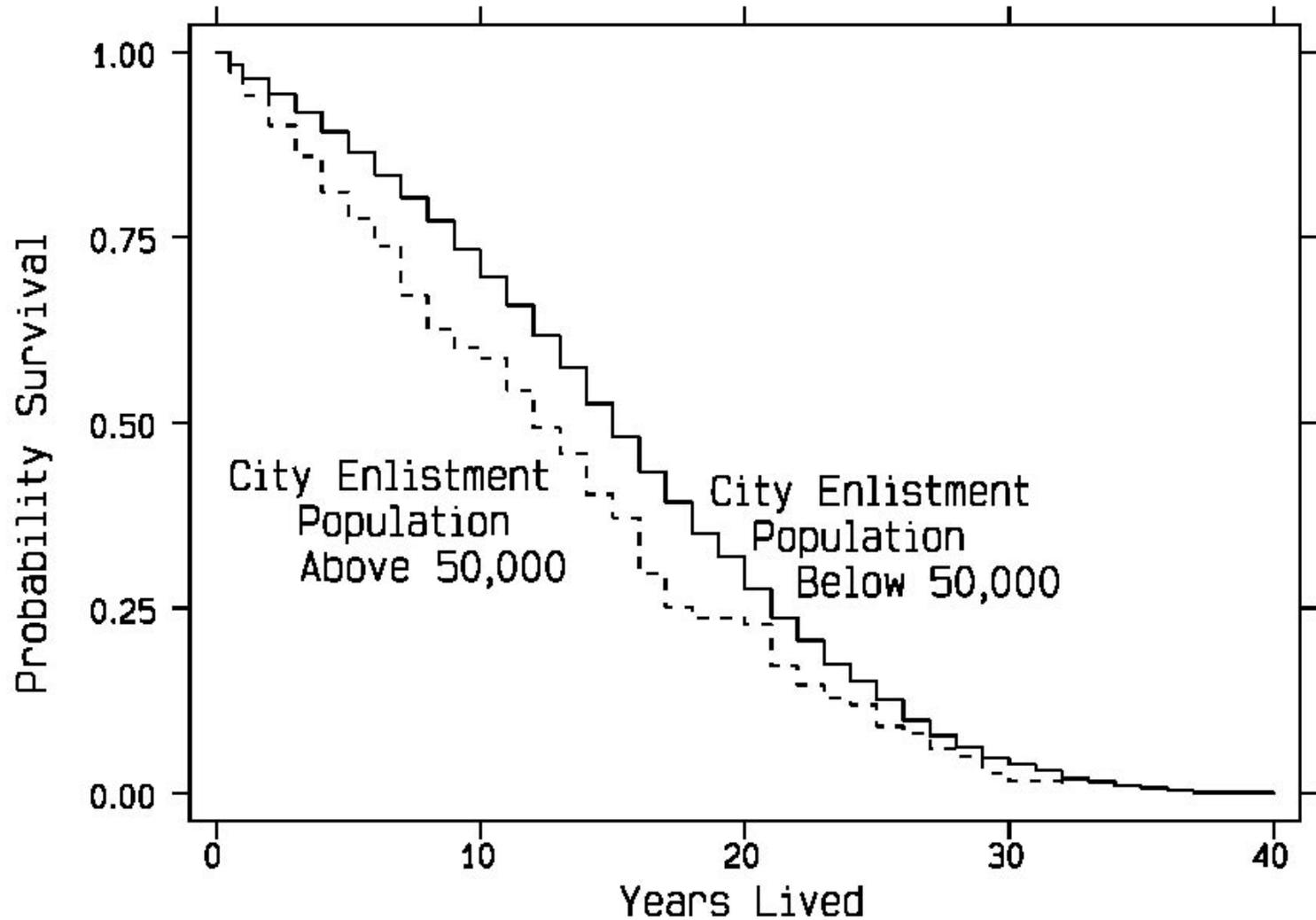
Proxying for Early Life Conditions

- Place of early life residence
 - Mid-19th century: largest cities deadliest
 - NY state: 229/1000 white children under age 5 died in urban areas vs 192/1000 in rural areas (Haines 1977)
 - End-19th century: largest cities no longer deadliest, medium size cities are worse because had not invested in sanitation infrastructure (Haines forthcoming)
 - Urban mortality penalty shifts to smaller and smaller size city class over time
 - By 1940 no longer an urban mortality penalty
 - Urban penalty associated with gastro-intestinal and respiratory disease (sanitation and crowding)

Cities and Mortality, White UA (Costa and Lahey 2005)

- If enlisted in city of 50,000+ (one of 13 largest cities) then 1.2 times as likely to die from all-cause mortality at ages 60-74 than man who enlisted in city of less than 2500 controlling for later residence
 - 1.6 times as likely to die of heart disease
 - 2 times as likely to die of respiratory disease
 - 2.5 times as likely to die of parasitic disease (insignificant)
- No mortality effect of being in one of 100 largest cities in 1900

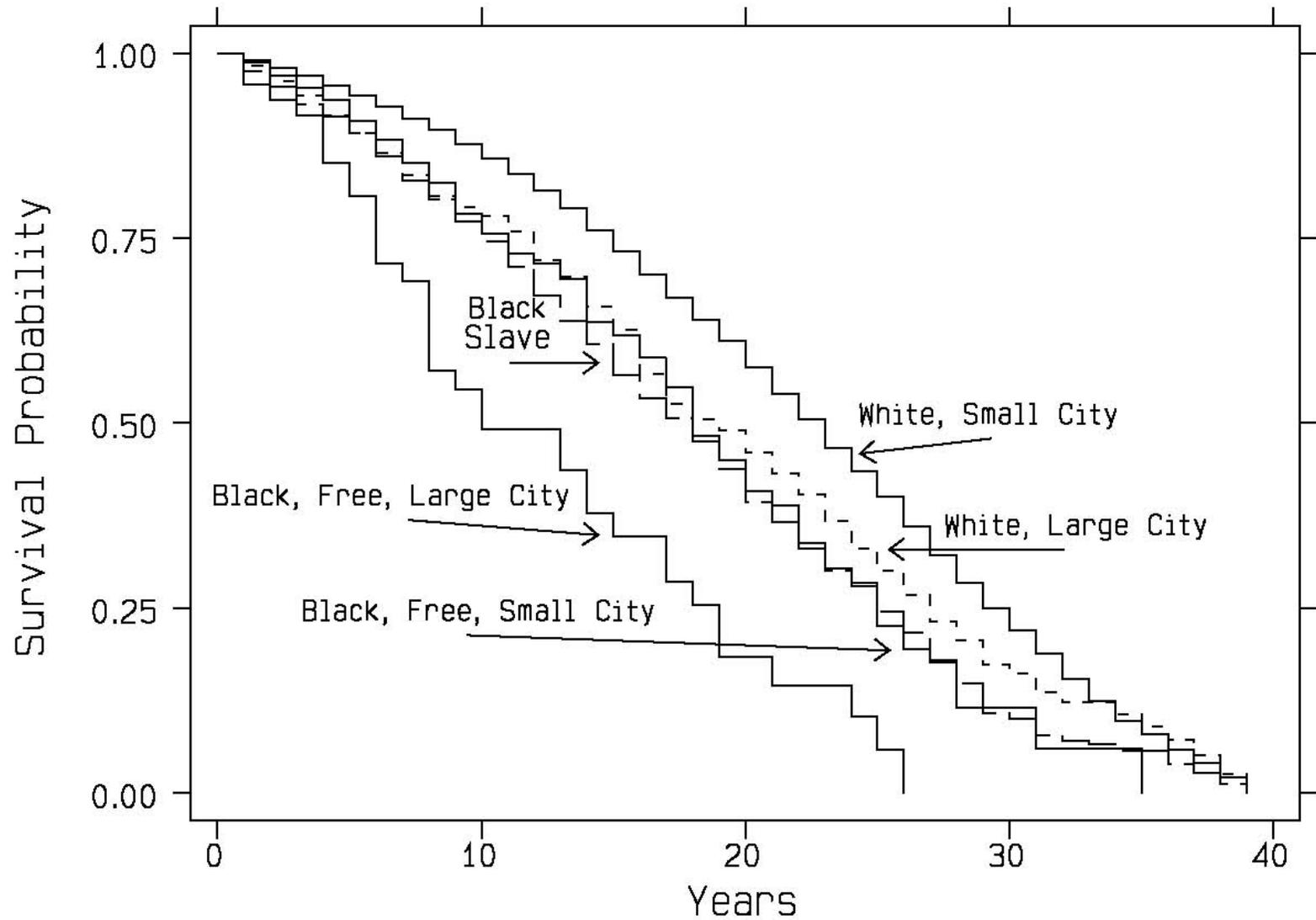
Figure 2: Survival Probabilities Over Time by Size of City of Enlistment, Union Army Veterans Age 60-74 in 1900



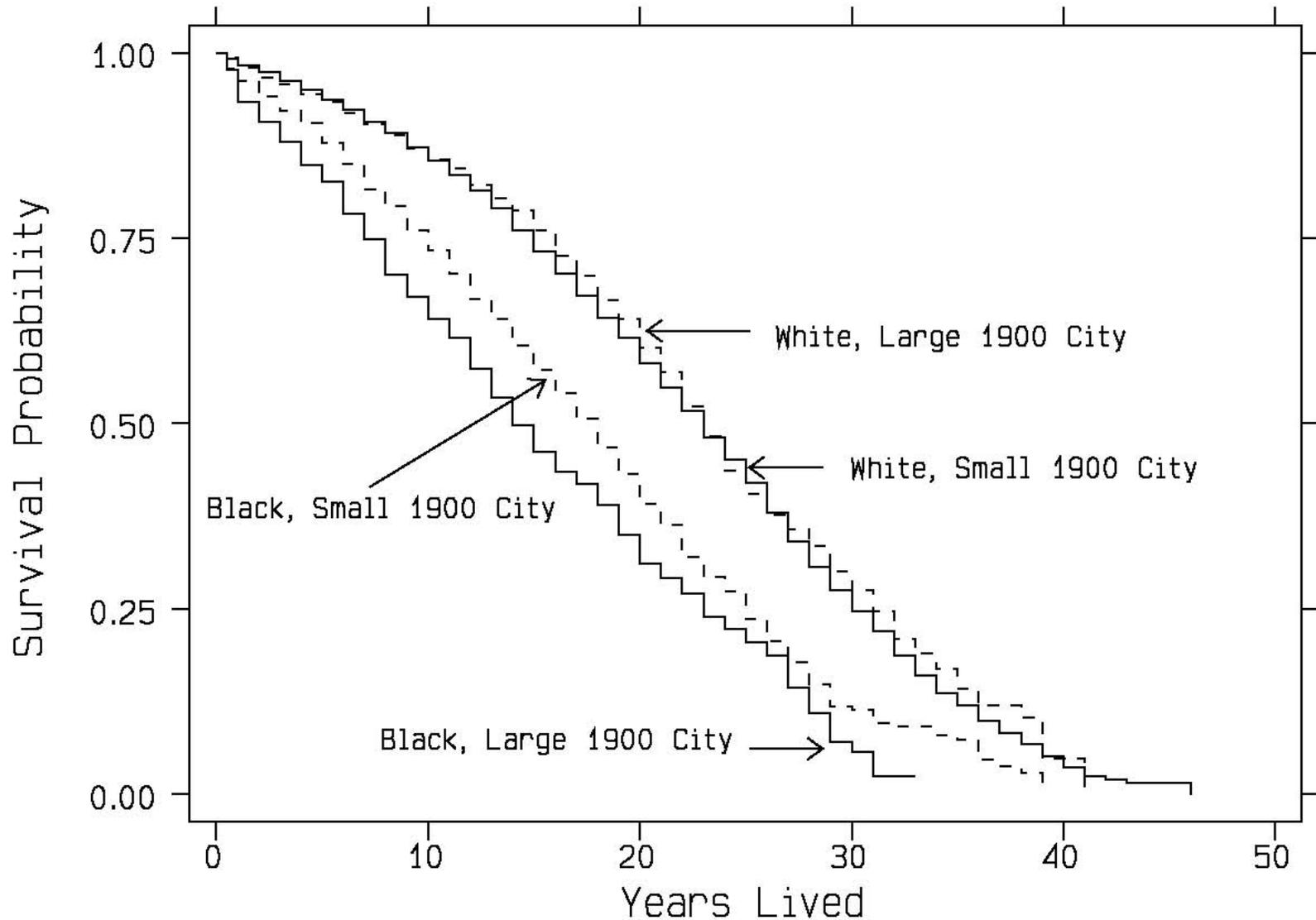
Cities and Mortality, Black UA

- Growing up in large northern cities had even greater scarring effects for blacks than for whites
 - e.g. during 1832 cholera epidemic case rate twice as high among blacks as among whites
- Living in large city at older ages increases black older age mortality
 - Decline in black child mortality lags white decline because sanitation extended later
 - Higher mortality both infectious and parasitic disease and chronic disease related to infection (e.g. syphilis)

Survivorship and City of Enlistment, UA by Race (Costa 2004)



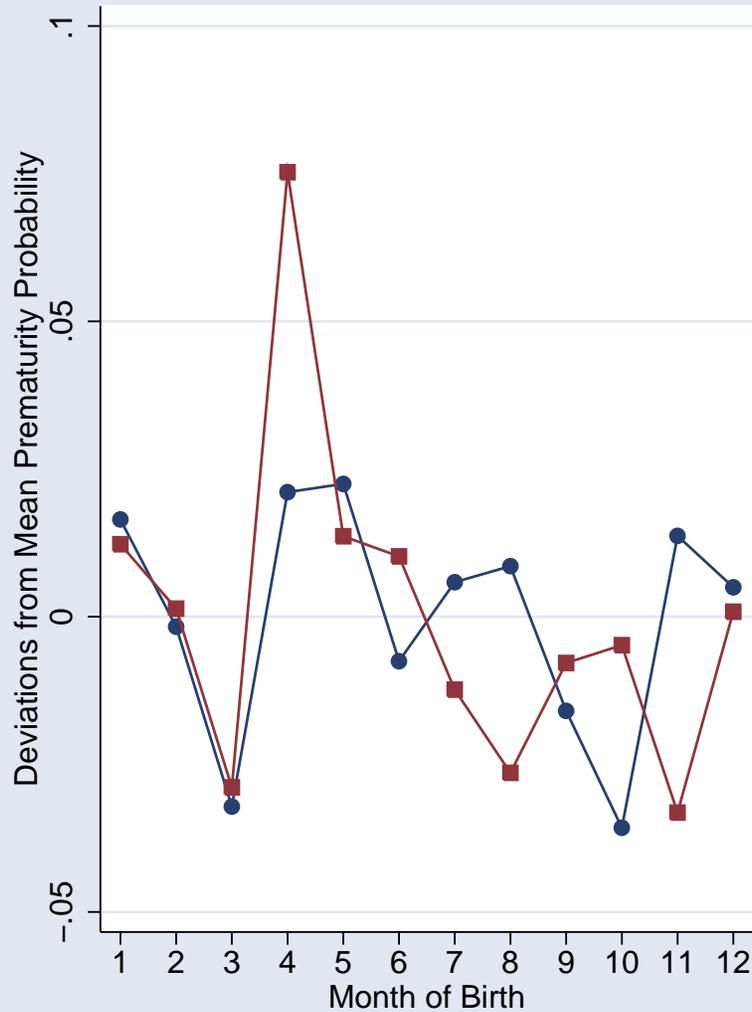
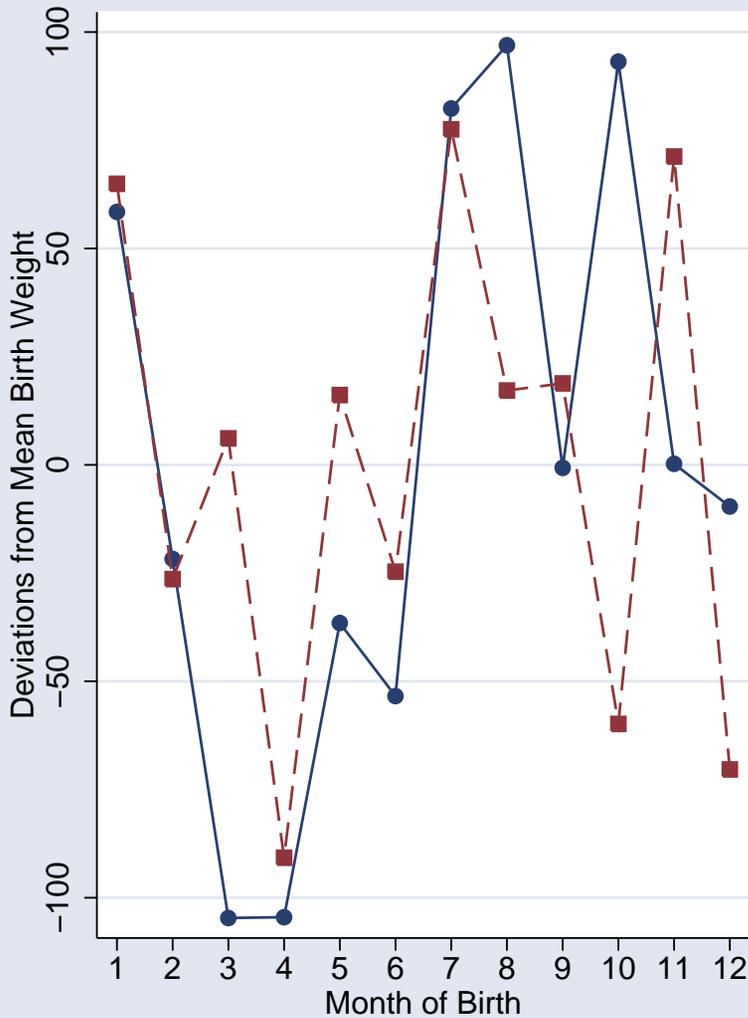
Survivorship and City of Residence in 1900 by Race, UA (Costa 2004)



Proxing for Early Life Conditions with Season of Birth

- Maternal nutrition in winter
 - Vitamin levels at lowest levels in spring in 1930s study
 - Respiratory disease in winter might also affect in-utero health
 - Birth weights at JHU, 1895-1935, lowest in spring (Mar-May) and prematurity rates highest in 2nd quarter (Apr-June)
 - Note: birth weight pattern shifted in 1950s and now lightest babies born in summer

Birth Weight and Prematurity Probability Deviations, JHU 1895-1935 (Costa and Lahey 2005)



Proxying for Early Life Conditions with Season of Birth, Cont

- Season of birth determines what environment born into
 - Mortality peaked in summer from diarrheal disease
 - Summer mortality effect begins to dampen in second half of 19th century and disappears by 1920 (Conrad and Lentzer 2003)
 - Infant summer mortality peak also determined by infant feeding practices (Conrad and Lentzer 2003)

Quarter of Birth and Mortality

- Doblhammer and Vaupel (2001): among 50+ if born in 2nd quarter instead of 4th in northern hemisphere live longer but if born in southern hemisphere pattern reversed

Changing Impact of Quarter of Birth (Costa and Lahey 2005)

- In UA data if born in 2nd or 3rd quarter relative to 4th, 9% increase in mean 10 year mortality rates
- In UA sample excess season of birth mortality due to heart and cerebrovascular (consistent with Barker findings)
- In 1960-80 data:
 - if born in 2nd quarter relative to 4th, 8% increase in mean 10 year mortality rates
 - If born in 3rd quarter relative to 4th, 4% increase in mean 10 year mortality rates

Explaining Mortality Decline

- Declining impact of season of birth accounts for 16-17% of mortality difference between UA and 1960-80 data
- Improvements in all measurable early life factors (inc. city size effects) account for perhaps 30% of mortality decline UA and 1970

Underlying Causes Improvements in Early and Late Life Conditions

- Economic growth
 - Less dependent upon seasonal agricultural cycle
 - Shift from manual to white collar work
- Scientific knowledge and health habits
 - Decline in typhoid mortality even before public health investments (Troesken 2004)

Underlying Causes Improvements in Early and Late Life Conditions

- Public health investments
 - Troesken (2004), Costa and Kahn (2004), Bleakley (2002)
 - Poor and blacks biggest beneficiaries because had fewest self-protection options
 - Public willingness to invest because of fear of infection but expenditures undertaken by cities low relative to value of lives saved (Costa and Kahn 2006)

Underlying Causes Improvements in Early and Late Life Conditions

- Innovations in medical care
 - Declines in debilitating effects of chronic conditions
 - Hard to attribute declines to medical care, but some easy cases:
 - UA vs veterans in 1980s: as likely to ever have had hernia, but now easily curable (Fogel and Costa 1997)
 - Cataracts for UA vets meant blindness (Costa 2002)

Implications: Future Trends

- Baby-boomers particularly long-lived and healthy
 - No longer urban penalty, childhood infectious disease rare, food supply less dependent upon agricultural cycle
- After the baby-boom cohort, mortality/disability decline may slow down
 - Early life conditions still improving, but much smaller changes relative to past
 - Improvements will need to come increasingly from better medical care or health habits

Implications (Cont.)

- Predicted mortality trends both bad and good news for Social Security systems
 - Still need to absorb baby-boom cohort
- Will there be fiscal benefits to improving health?
 - Not clear improving health will lead to increased labor force participation nor that it will reduce demand for medical care (esp if some else pays for it)

Implications, Cont

- Should we still be investing in improving health?
 - Yes. Value of life is increasing. Income elasticity of value of life ~ 1.6 from 1940-80. Even marginal improvements in value of life have high value added, higher than large improvements in life expectancy at beginning of century (Costa and Kahn 2004)

Per Person Value of Mortality Decline

| | 1900-20 | 1920-40 | 1940-60 | 1960-80 | 1980-2000 |
|--|---------|---------|---------|---------|-----------|
| Age-adjusted mortality decline per year (deaths per 1,000,000) | 3,709 | 3,621 | 4,458 | 3,001 | 1,671 |
| Value decline per person (in 1,000s 1990 \$) per year | 1,771 | 2,970 | 6,860 | 11,136 | 11,732 |
| Increase national health care expenditures per person per year | | 102 | 369 | 1,045 | 1,824 |